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Procedia Manufacturing 3 (2015) 3424 – 3431

Procedia MANUFACTURING

6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015

Gamification of business processes: Re-designing work in production and service industry

Oliver Korn, Albrecht Schmidt

University of Stuttgart, VIS, Pfaffenwaldring 5a, 70569 Stuttgart, Germany

Abstract

In this work we provide an overview of gamification, i.e. the application of methods from game design to enrich non-gaming processes. The contribution is divided into five subsections: an introduction focusing on the progression of gamification through the hype cycle in the recent years (1), a brief introduction to gamification mechanics (1) and an overview of the state of the art in established areas (3). The focus is a discussion of more recent attempts of gamification in service and production (4). We also discuss the ethical implications (5) and the future perspectives (6) of gamified business processes. Gamification has been successfully applied in the domains education (serious games) and health (exergames) and is spreading to other areas. In recent years there have been various attempts to "gamify" business processes. While the first efforts date back as far as the collection of miles in frequent flyer programs, we will portray some of the more recent and comprehensive software-based approaches in the service industry, e.g. the gamification of processes in sales and marketing. We discuss their accomplishments as well as their social and ethical implicatio. Finally a very recent approach is presented: the application of gamification in the domain of industrial production. We discuss the special requirements in this domain and the effects on the business level and on the users. We conclude with a prognosis on the future development of gamification.

Keywords: Gamification; Assistive technology; Computer-assisted instruction; Augmented reality; Human machine interaction

1. Introduction

Gamification is a delightful concept: it is a creditable idea to use "video game elements to improve user experience and user engagement in non-game services and applications" [1]. After all, increased engagement is claimed to have numerous benefits like improved performance and greater user satisfaction [2]. However, while the integration of gamification mechanics (section 2) has a long tradition in health and education (section 3) it is just

doi:10.1016/j.promfg.2015.07.616

starting to be established in the service industry (section 4.1.) and it is not yet established in industrial environments (section 4.2.).

This is why we argue that an aggregated perspective as provided by the Gartner hype cycle diagrams (Figure 1) is misleading: this highly aggregated perspective cannot not take into account the gamification's different levels of readiness in specific domains.

While the diagrams imply that gamification in 2015 is well on its way into the "through of disillusionment" we argue that this perspective is focusing on the gamification of regular business processes like in the service industry. For the gamification of health and education we will show that gamification has at least progressed a large part of the "slope of enlightenment", if not entered the "plateau of productivity". For the gamification of production we argue that gamification has not yet reached the "peak of inflated expectations".

2. Gamification mechanics

The basic mechanics of gamification are closely related to the mechanics of game design: addressing the human desire for socializing, learning, mastery, competition, achievement, status, self-expression, altruism, or closure [3]. An important element of games and thus gamification is to make small steps of progress visible and thus look greater. This can be achieved by progress bars, badges, levelling, achievements and similar elements. Such elements are usually easy to integrate as they use existing data which is just portrayed differently. For example the data of a counter which identifies individual visitors of a website could be used to generate a levelling system, promoting visitors every ten visits. A similar element which can be easily exploited for gamification are posts in forums. Such reward structures effectively address the desire for social progression. To add a sense of competition, leaderboards can be integrated. If social aspects play an important role, elements like avatars and reputation systems are good options.

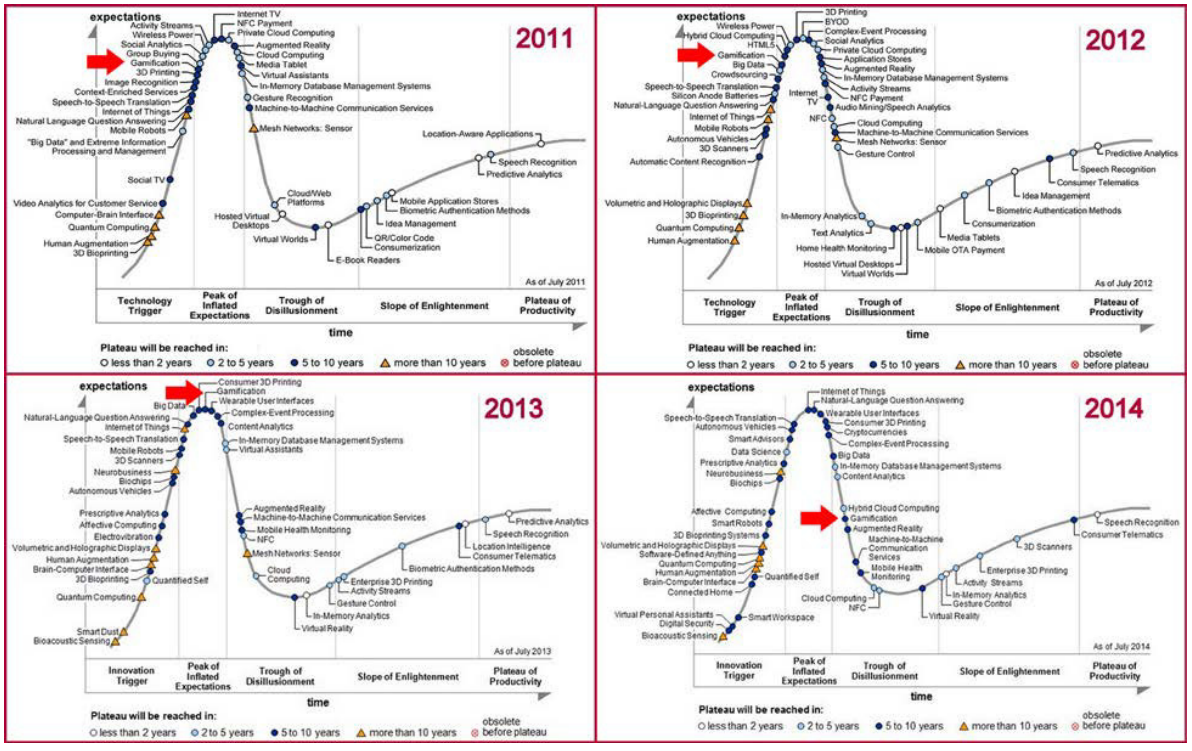

Fig. 1. The rise and decline of the concept of gamification in the years 2011 to 2014. The highly aggregated perspective of the hype cycles provided by Gartner cannot not take into account different areas of application. Copyright granted by Gartner Public Relations.

The list of possible gameplay mechanics to be exploited for gamification is long and growing – as is the list of employable game mechanics. Often such lists contain redundancies and overlaps as well as buzzwords like “epic meaning” or “blissful productivity” (both popularized by the heroine of gamification, Jane McGonigal [2]). In practice, the choice of suitable game mechanics and their implementation in a gamified solution will be strongly driven by the targeted users and the targeted domain. A good example of a domain-specific mapping of gamification to general business processes was given in 2009 by Reeves & Read [4]. Their work meticulously maps game elements like avatars, leaderboards, leveling and reputation to general business processes.

However, more recently the application of gamification is also discussed controversially as a potential threat to intrinsic motivation and a potential source of quarrels between employees (section 5: Ethical Implications of Gamified Work). These discussions might have to be considered when selecting suitable elements from game design for work environments.

3. State of the art: Gamification of education and health

In this section we will portray some examples of gamification in the domains health and education which – in spite of their structural differences as resulting from the high level of regulation and governmental control – for this purpose are considered as business sectors.

It was in educational contexts that some years ago the term “serious games” was established for learning software with multimedia elements and small games. This origin is natural, since “learning games” are probably as old as institutionalized learning: countless illustrated stories and mnemonic tricks show that pedagogy and games are strongly related. The serious games approach, i.e. the use of elements from game design to improve learning, is an example of “gamification” before that term was widely used.

The difference between regular and “serious” games is that the latter promote “serious” purposes, such as learning a foreign language or traffic signs. If we follow the philosopher Bernard Suits’ sententious definition of gaming, that “playing a game is the voluntary attempt to overcome unnecessary obstacles” [5], serious games as well as gamified applications in other areas are no “real games” because they have a purpose outside of themselves – they have “necessary obstacles”.

Like education, healthcare is an area where often only repeated exercises lead to success. So in both learning and training or rehabilitation, motivation and the ability to tolerate a certain amount of repetitiveness are key success factors. Thus it was a natural step from “serious games” to “games for health” and later “exergames” (a portmanteau of exercise and games). One of the first examples of a game with a medical aim was *Re-Mission* developed by HopeLab in 2007 – a shooter game where children with cancer could actively fight against virtual tumor cells. Playing the game led to a significantly higher reliability in the children’s medicine intake [6]. In 2007 the “games for health” approach (i.e. the gamification of health) reached a new level with the release of Nintendo’s Wii, which uses the accelerator-based Wii Remote and Balance Board. They allow to detect movements in three dimensions and made the user interact more directly with various health applications. Soon scientists and physicians started to exploit the motion analysis capabilities for therapeutic exercises. The effects were promising: an analysis of efficacy between traditional and video game based balance programs showed positive evidence for the latter [7]. A well-documented example is the game *VI-Bowling* which helped visually impaired users to increase their throwing skills [8]. An example targeting elderly users is *SilverPromenade* which simply allows players to go on virtual walks [9].

When the Kinect was launched in 2010 the technological cycle of adopting and adapting video game motion technology initiated by the Wii started anew. An increasing number of researchers and therapists wanted to make use of the new markerless motion tracking capabilities to “gamify” medical and health treatment. One of the first Kinect-based games built for therapeutic purposes was *motivotion60+* (Figure 2) which includes several gamified balance and strength exercises that help senior citizens to prevent falls [10].

a b

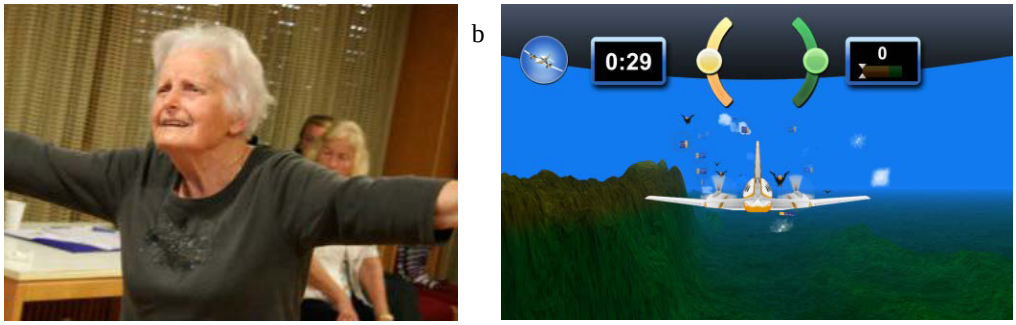

Fig. 2. A senior woman (a) using one of the exergames developed for balance training (b).

Another medical condition frequently covered by gamification approaches are strokes. These often imply therapies requiring highly repetitive exercises, either on the physical or on the cognitive level and in many cases on both. An example is *Break the Bricks* which helps stroke patients to recover their psychomotor abilities [11].

4. Gamification in service and production industry

In the first part of this section we portray gamification attempts in service industry, e.g. the gamification of sales and marketing. In the second part we present a recent approach of applying gamification in the domain of industrial production.

4.1. Gamification in the service industry

After gamification has been successfully applied in the domains education (serious games) and health (games for health, exergames) it is spreading to other areas. In recent years there have been attempts to “gamify” business processes. As mentioned above, the concept of applying gamification to general business processes has been described by Reeves & Read [4]. A more recent discussion of gamification as a “social technology” for companies is provided by Hugos [12]. However, decades before there have been predecessors of gamification in business. A commonly known example are frequent flyer programs. Starting in 1972 these awarded members with special bonuses or “rewards”. Nelson [13] describes another predecessor: the 1990s-2000s American management trend of “fun at work” proposed reimagining the workplace as a fun and playful locale rather than one of work and drudgery, recapturing some of what was seen as an intrinsic, child-like play. Nelson even claims there was a tradition of gamification in the Soviet Union, where factories were awarded points for performance and could win commendations as they surpassed various point thresholds.

This exemplifies that the business approach “management by objectives” already implicitly has taken a step into the world of games. In gaming, missions and goals need to be stated explicitly to make them transparent for the players and measurable for the software (section 2). Thus it is not surprising that gamification was very well received in business contexts: in 2011, at the begin of the gamification hype cycle, Gartner very optimistically predicted that 70 percent of Global 2000 businesses will manage at least one “gamified” application or system by 2014 [14]. Such predictions or the corresponding high market volumes become more reasonable, if “employers can use Gamification to incentivize employees by establishing clear goals and rewarding those employees that achieve those goals.” In such a very broad understanding of gamification – as put forward in the 2013 article “The Phenomena of Gamification – The Next Big Thing for Employers” [14], the gamification of business processes primarily is a visualization of management by objectives.

With respect to its application in the service industry Huotari & Hamari define gamification as “a process of enhancing a service with affordances for gameful experiences in order to support user’s overall value creation” [15]. They argue that the gamification in service industry cannot be based on a set of methods or mechanics, but has to be understood more broadly as a process in which the gamifier is attempting to increase the likelihood for the gameful experiences to emerge by imbuing the service with affordances for that purpose (be it badges or more implicit cues).

The term affordance in this context refers to any qualities of the service system that contribute to the emergence of gameful experience. Thus the authors favor the broad understanding of gamification described above.

Castellan et al. illustrated how gamification can be used in the service industry, in work environments like call centers to help agents and supervisors managing their performance [16]. They also describe a private social network designed by PlayVox for contact centers including a gamified training system. The system has been advertised by quoting the customer GroupOn Latin America as follows: “PlayVox lets us detect and make a quick diagnosis of underperforming agents or those who ignore certain important procedures in serving our customers.” Here gamification is used as a tool to find and dismiss underperforming employees. With respect to the creditable idea of using video game elements to improve user experience and user engagement in non-game services and applications (see introduction) this might be seen as a perversion of gamification. However, most games are designed to have both winners and losers – so while the application of gamification in this example might be unethical, it is not unnatural and definitely not unusual as a cost-cutting strategy in the service industry.

The fascination for gamification in the service sector seems to be fueled by the increased measurability of service processes which are per se difficult to standardize and structure – especially in comparison to processes in industrial production environments.

4.2. Gamification of production

It is surprising that gamification has not yet spread into industrial production: many processes in this domain have physical outcomes (e.g. the number of parts produced at a specific machine per hour). These outcomes usually are already measured and transferred to business intelligence systems like ERP or PPS (Enterprise Resource Planning; Production Planning System). Thus gaming elements like progress visualization, scores and leaderboards could be implemented with little effort and their use seems like a natural step.

However, the assistive systems currently used in industrial production do not incorporate gamification elements. Their purpose is regulating production time and serving as a “quality gate”. This means they are designed to support a steady production speed and identify and remove “waste” (i.e. failed products) from the workflow. Until recently the user experience of the workers when working with these systems was a minor concern. Most manufacturers are very conservative when changing human machine interaction (HMI) and prefer “safe and slow” over “new and intuitive”. As a Fraunhofer HMI-study explains, from the variety of modern interaction techniques, so far only touch screens (Figure 3, left) found their way into production environments [17].

This conservative attitude is a result of their higher security and reliability requirements. New forms of HCI are more readily implemented in HMI environments if they have become part of an accepted standard such as ISO 9241 [18]. However, social engineering methods such as gamification are not yet in their focus: if current assistive

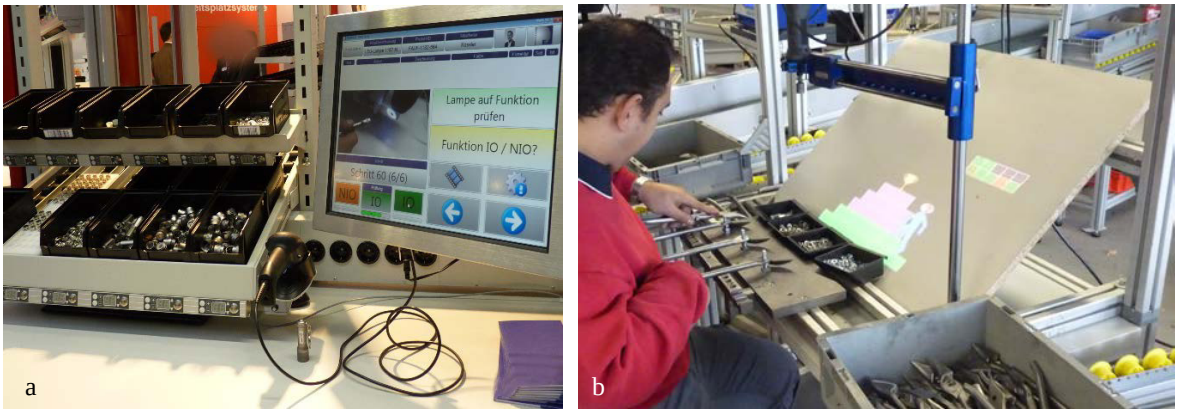

Fig. 3. (a) A workplace-integrated assistive system typical for the current state of the art. It uses a monitor to display instructions for upcoming assembly tasks. (b) A workplace integrating gamification (here: a pyramid). The visual elements are projected in front of the work area.

systems in production use visualization at all, they focus on describing the upcoming working steps on a display, usually as a combination of an image and a technical text (see Fig. 2, left).

This has changed recently. In 2012 Korn introduced a first concept for gamification of industrial workplaces [19]. In the research project motionEAP (2013-2016), ways to improve assistive systems in production environments are explored. One targeted improvement is the implementation of gamification elements.

As the above discussion of HMI in production shows, gamification in this domain has to meet specific requirements. In opposition to games or computer-based office work, the user's default focus in production work is not a software but the physical product itself and several machines and tools. This results in a dilemma: gamification elements might distract the user from the main work focus. This is why the visualization of gamification has to be kept simple, e.g. by avoiding moving elements. This also implies that a direct interaction with the gamification (e.g. pressing a like-button) should be avoided. This can be achieved by using motion recognition to allow implicit interaction [20]. However, the integration of motion sensors in a work context represents another step on the way towards a "quantified self" and will surely raise legal and ethical questions. Another way to reduce distraction is projecting the elements directly into the workplace [21] instead of using a monitor. Both requirements were addressed as shown in Fig. 3 (right).

The gamification approach uses a pyramid to visualize a production sequence (e.g. the assembly of a component). Each work process (e.g. picking the first part) is a step on this pyramid which is climbed by a user avatar. To provide the user with feedback on quality and speed within a single work process, the pyramid-gamification approach uses color-coding to visualize the progression of time. The current work process starts in dark green and slowly changes color to yellow, orange and finally red. The duration of that color change is derived from calibration runs, so it is user-specific. As only the color of one step changes, the amount of change within the whole gamification visualization is deliberately kept at a minimum. At the end of a sequence the visual result is a pyramid with one colored plateau per process. If there was no mistake, the figure also reaches the cup on the pyramid's top. The importance of reaching this goal is heightened by (optionally) personalizing the figure's head with a photo of the worker. A completed pyramid is moved up to the board on the top right while its color is changed to show average performance: if half of the processes were done quickly (= green bar) and the other half slowly (= red bar), the resulting pyramid is colored orange. However, the pyramid is always completely red if a mistake was made.

First studies [22] show that the users like the pyramid-implementation more than previous concepts and that it has a positive effect on the overall motivation. However, the longevity of this motivational effect needs to be validated in long-term studies. Also it is possible, that such an integral form of gamification influences long-term motivation, i.e. the removal of the system might lead to a strong decrease in motivation and performance. Such ethical issues are discussed in more detail in the following section.

5. Ethical implications of gamified work

As the discussion of the approaches in the service sector shows, new issues arise as soon as gamification is implemented in work contexts. Apart from obvious potentials of misuse, there are structural and even philosophical questions. Recently the concern was raised that replacing intrinsic rewards with explicit ones may in the long run reduce work motivation [23]. In the meanwhile the discussion of the downside of gamification has reached the blogosphere as the article "The dark side of gamification" [24] illustrates. Amongst other problems it claims that gamification can trivialize serious issues, reinforce the wrong mindset and – again – contaminate motivation. This discussion shows the principal ethical or even philosophical dimensions of the gamification of work.

The issues of modeling and adapting to users in assistive systems (which is the core of what gamification does) have recently been formalized in a model for the "ethical evaluation of socio-technological arrangements" in the domains care and health [25]. The approach separates three layers of analysis: the societal, the organizational and the individual. Within these layers seven topics are addressed: care, self-determination, security, justice, privacy, participation and self-concept. Based on this analysis, the approach differentiates between four ethical verdicts:

1. The application is completely uncritical from an ethical point of view.
2. The application is ethically sensitive, however the issues can be addressed in practical application.

3. The application is ethically highly sensitive; it either has to be permanently monitored or should not be introduced.
4. The application should be rejected from an ethical point of view.

Currently already the distribution of verdicts (one neutral, three critical) shows that the model focuses on negative effects – as might be expected in the sensitive areas care and health, where autonomy plays an important role.

This is structurally different in work environments where – in spite of flat hierarchies and partner leadership – people are hired and paid to work and usually get "released" if they fail or refuse to do so. In work contexts people are willing to accept a higher degree of external control and thus a loss of autonomy. However, while in business gamification might primarily be a means towards improved work results, the path towards this goal implies changing the employees' mindset. Thus the ethical obligations when applying gamification are higher than in usual work scenarios. Especially if gamification is used to conceal a user's performance monitoring (section 4.1.), its use has to be considered unethical.

6. Conclusion

If we follow Gardner's hype cycle (section 1), gamification in 2015 is well on its way into the "through of disillusionment." However, we argue that this perspective is only focusing on the gamification of regular business processes like in the service industry (section 4.1). For the gamification of health and education (section 3) we showed that there are solutions which have at least progressed a large part of the "slope of enlightenment", if not entered the "plateau of productivity". In contrast, for the gamification of production (section 4.2.) we argue that it has not yet reached the "peak of inflated expectations".

While the adaptation of gamification mechanics (section 2) for the domain of production proved to work well in the first field studies, it will take considerable time until this innovation permeates the thick layer of standards and security requirements established in the industrial domain.

We think that the future development of gamification is not primarily narrowed by technical problems. In fact, the ubiquitous use of advanced sensor technologies and the societal trend towards a "quantified self" join well with gamification and further its progression into business domains. The challenge lies more on the ethical and potentially also on the legal level. Only if these challenges are successfully addressed, gamification has the potential to become an accepted, vital and constantly evolving part of modern business processes, both in the service and the production industry.

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